BRITISH GEOLOGICAL SURVEY

MARINE REPORT SERIES
TECHNICAL REPORT WB/95/35

BGS TECHNICAL REPORT WB/95/35

The Wight 1:250 000-scale Solid Geology sheet (2nd Edition)

by

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Geographical index
Wight, English Channel

Subject index:
Solid Geology

Production of report was funded by:
Science budget

Bibliographic reference:
Andrews, I.J. 1995. The Wight 1:250 000-scale Solid Geology sheet (2nd Edition)
British Geological Survey Technical Report WB/95/35

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1. INTRODUCTION

The British Geological Survey completed its coverage of first editions of the UK land and continental shelf area at a scale of 1:250 000 in 1992. The series consists of sea bed sediment maps, Quaternary geology maps, solid geology maps, gravity anomaly maps and magnetic anomaly maps on a 1° by 2° UTM grid. The Wight Sheet covers part of the central English Channel and part of adjacent southern England as delimited by the points 51°N 2°W, 51°N 0°E, 50°N 0°E and 50°N 2°W.

The first edition of the Wight Sheet (solid geology) was the first of the solid geology maps in this series and was published by the then IGS in 1977. It was compiled not by BGS geologists but by D. Curry and A.J. Smith (University College, London) and D. Hamilton (University of Bristol).

On completion of the 1:250 000 map series in 1992, it was decided that the Wight Sheet (solid geology) should be the first to be revised and reprinted. A large amount of new data, mainly in the form of petroleum wells, seismic coverage and revised onshore mapping, suggested that a more up-to-date and comprehensive map could be produced.

This report should be read in conjunction with the Wight Sheet (second edition) 1:250 000 scale solid geology map. Any request for further information should be addressed to:

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2. DATASET

2.1 Onshore

The aim of the 1:250 000 solid geology series is to show principal chronostratigraphical divisions down to series level (e.g. Lower Cretaceous, Upper Cretaceous, Paleocene, Eocene and Oligocene) by colour. Onshore, where considerably more detail is available, subdivision down to formation level is commonly possible at this scale. This is shown by assigning each formation an age (e.g. 'gb') and, where appropriate, by the addition of a lithological overprint (e.g. sandstone stipple). Where outcrops are particularly narrow, for instance in steeply dipping zones, units are combined (e.g. 'kekc' includes the whole of the Chalk).

(a) BGS geological maps

The outcropping geology of the land area has been taken directly from the latest available BGS geological maps, many of which had been remapped since the first edition Wight Sheet (Fig. 1).

Information down to formation level was digitised from the sources shown on the index map on the Wight Sheet, and then replotted at a scale of 1:250 000.

(i) *revised 1:50 000 maps*

The following 1:50 000 maps have been recently published: Brighton and Worthing, Bournemouth, Southampton and Portsmouth.

(ii) *revised 1;10 000 mapping*

The Fareham, Chichester and Bognor 1:50 000 sheets are in the process of being remapped and the latest information has been taken from the revised 1:10 000 maps (see, for example, Berry and Shephard-Thorn, 1982; Shephard-Thorn *et al.*, 1982; Hopson, 1994).

(iii) *old 1:63 360 mapping*

The gaps in the 1:50 000 and 1:10 000 remapping are: the Ringwood, Lymington, Isle of Wight and Swanage sheets, plus the Chalk of the Fareham and Chichester sheets and very small parts of the Haslemere, Horsham and Tunbridge Wells sheets. Of these, only the Ringwood Sheet causes major problems; this is because a large area of Palaeogene sediments have been reclassified since the last (1902) mapping. Dr E.C. Freshney supplied new linework for this area, in part using borehole

information.

(b) Seismic data

A significant amount of oil company seismic data has been shot onshore in the Wight Sheet area. Due to its confidentiality, this data has not been used in this study, apart from constraining gross unit thicknesses on the isopach maps and cross-sections.

(c) Released commercial boreholes

Twenty-eight deep boreholes drilled by oil companies onshore in the Wight Sheet area have been officially released from confidential status by the Department of Trade and Industry (Table 1). Two geothermal boreholes drilled by IGS/Department of Energy are also available. Details of a further three have also been published by Falcon and Kent (1960): Arreton-1, Portsdown-1 and Henfield-1.

These wells have been used in the construction of the stratigraphical column, borehole correlation, isopachs, structure contours and cross-sections.

2.2 Offshore

Offshore, the main map shows the distribution of solid geology either at the sea-bed or beneath sea-bed sediments or Quaternary deposits. Information is obtained from several sources, namely sea-bed samples, shallow boreholes and deep commercial wells (although in the latter case the shallowest sediments are generally not sampled).

Well name	National Grid East	North	County	Company	Year	Release number
Arreton-1	453091	85645	Isle of Wight	D'Arcy	1952	-
Arreton-2	453200	85800	Isle of Wight	Gas Council	1974	Onsh 3
Baxter's Copse	1491496	117733	West Sussex	Conoco	1983	Onsh 10
Chilworth-1	439279	117982	Hampshire	Amoco	1983	Onsh 10
Clanfield-1	471324	116541	Hampshire	Carless	1985	Onsh 11
Cowes-1	450036	94173	Isle of Wight	North Sea Sun	1983	Onsh 10
Cranborne-1	403408	109073	Dorset	BP	1972	Onsh 2
Fordingbridge-1	418756	111811	Hampshire	BP	1958	-
Henfield-1	517990	114570	West Sussex	D'Arcy	1936	-
Hinton Manor-1	467951	114885	Hampshire	Carless	1985	Onsh 11
Hoe-1	438450	119150	Hampshire	Amoco	1982	Onsh 10
Horndean-1A	471537	112602	Hampshire	Carless	1982	Onsh 10
Horndean-2	472615	112236	Hampshire	Carless	1984	Onsh 11
Horndean-3	470549	112531	Hampshire	Carless	1984	Onsh 11
Horndean-4	466298	113464	Hampshire	Carless	1984	Onsh 11
Lee-on-Solent-1	457434	101154	Hampshire	North Sea Sun	1984	Onsh 11
Lewes-2	540020	107710	East Sussex	D'Arcy	1936	Onsh 6
Marchwood-1	439910	111180	Hampshire	Dpt of Energy	1979	Onsh 9
Middleton-1	497394	101505	West Sussex	Penzoil	1971	Onsh 1
Portsdown-1	463891	106527	Hampshire	D'Arcy	1936	-
Portsdown-2	463937	107380	Hampshire	D'Arcy	1948	Onsh 7
Potwell-1	463990	107740	Hampshire	Carless	1985	Onsh 11
Sandhills-1	445700	90850	Isle of Wight	Gas Council	1982	Onsh 9
Southampton-1	441559	112018	Hampshire	IGS	1981	Onsh 9
Stanmer-1	532631	111423	East Sussex	Carless	1985	Onsh 11
Wilmingham-1	436623	87790	Isle of Wight	North Sea Sun	1984	Onsh 11
Woodlands-1	406590	106272	Dorset	BP	1968	Onsh 1
Wytch Farm-F15	401043	85742	Dorset	British Gas	1980	Onsh 8
Wytch Farm-F16	401043	85742	Dorset	British Gas	1980	Onsh 8
Wytch Farm-F17	401043	85742	Dorset	British Gas	1981	Onsh 9
Wytch Farm-F18	401043	85742	Dorset	Gas Council	1981	Onsh 9
Wytch Farm-F19	401043	85742	Dorset	Gas Council	1981	Onsh 9
Wytch Farm-F23	401043	85742	Dorset	Gas Council	1981	Onsh 9
Wytch Farm-25	400939	87049	Dorset	BP	1985	Onsh 11

Table 1: list of released, onshore petroleum wells in the Wight Sheet area at the time of completion of the sheet compilation.

As with the onshore part of the map, the offshore section shows principal chronostratigraphical divisions down to series level by colour. Further subdivision is by:

(1) chronostratigraphical stages in the Palaeogene (i.e. gt, gy, gl, gb, go) and Upper Cretaceous (i.e. ke, kt, ktkc), where subdivision purely based on lithology is not possible.

(2) major lithostratigraphical groupings in the Jurassic and Lower Cretaceous (i.e. Oxford Clay and Corallian Beds, Kimmeridge Clay, Portland and Purbeck Beds, Wealden Group and Lower Greensand, Gault and Upper Greensand), where lithofacies is more diagnostic.

(a) BGS shallow boreholes

Eleven shallow boreholes were drilled by BGS from *mv Whitethorn* in June-August 1975 in the Wight Sheet area (Dingwall and Lott, 1979):

75/27 (+50-02/223)	4.3m of sand on 10.9m of lower London Clay (early Ypresian) on 9.4m of Woolwich and Reading Beds (Thanetian) (Dingwall and Lott, 1979); all classified as London Clay by Hamblin *et al.* (1993)
75/28 (+50-02/229)	0.5m sand on 2.5m of Durlston Formation (Ryazanian)
75/29&29A(+50-02/230)	42.8m of Lower to Middle Chalk (Cenomanian-Turonian) on 20.2m of Upper Greensand (upper Albian) on 7m of Gault Clay (middle Albian) on 6.9m of Lower Greensand (lower Albian-?Aptian)
75/31 (+50-02/231)	1m sand on 24m of Purbeck or Wealden facies (barren)
75/32 (+50-02/232)	29.4m of lower Kimmeridge Clay Formation (Mutabilis zone of lower Kimmeridgian)
75/33 (+50-02/240)	14m of upper Kimmeridge Clay Formation (Elegans-Scitulus zone of upper Kimmeridgian)
75/34 (+50-02/241)	1m gravel on 47m of Poole Formation (middle to upper Ypresian)
75/35 (+50-02/242)	10m sand on 66.4m of Atherfield Clay, Lower Greensand (Forbesi zone of Aptian)
75/36 (+50-02/229)	1m sand on 2.7m of Durlston Formation (Ryazanian)
75/37 (+50-01/105)	2m gravel on 59.5m of Wealden Group (Ryazanian-Barremian)
75/38 (+50-01/106)	3.5m gravel on 58.7m of Barton Clay Formation (W. (R) perforata and W. (R) draco zones of Bartonian)

For a detailed micropalaeontological study of these boreholes see Warrington and Owens (1977).

(b) Sea-bed samples

A variety of sea-bed samples have been collected within the Wight Sheet area using Shipek grab and vibrocorer or gravity corer. However only those sites at which solid rock samples were recovered have been considered here (for details of other samples see Lawson and Hamblin, 1989).

(i) *BGS samples*

Only 40 BGS samples were available at the time of the first edition Wight Sheet. Since its publication,

a further 108 samples have been collected. These were collected during 1981-85 surveying, and a 1988-89 aggregate survey commissioned by the Department of the Environment and the Crown Estate Commissioners (Hamblin and Harrison, 1989).

Many of the solid rock samples have been analysed by BGS palaeontologists, and the following reports deal with samples in the Wight sheet area: 75/187, 75/207, 76/22, 81/48 (nannoflora), 81/145, 83/290 (Upper Cretaceous foraminifera), 84/45, 84/113 (palynology), 84/123 (palynology), 84/145 (palynology) and 85/32 (foraminifera). Reports 75/208, 75/134, 76/14 (borehole 75/38) and 76/111 (borehole 75/37) also refer to the sheet.

(ii) *Non-BGS samples*

Sea-bed sample information for 267 sites was extracted from the following published sources and used in the first edition map: Donovan and Stride (1961), Curry (1962), Larsonneur and Rioult (1969), Dingwall (1971) including samples taken to the east of the Isle of Wight by Admiralty vessels in 1956-58 and Pomerol (1972). Unpublished data from W.R.B. King and J-P. Auffret were also included.

No further non-BGS samples have been made available in this study. The Bureau de Recherches Géologiques et Minières (BRGM) have not undertaken any recent surveys in the southern part of the Wight sheet which lies within French territorial waters (P. Guennoc, pers. comm.).

(c) Released commercial wells

The following 14 wells drilled by oil companies in the offshore Wight Sheet area have been released by the Department of Trade and Industry:

Well number	Latitude	Longitude	Company	Year	Release number
98/6-8	50 41 26.4 N	1 51 29.9 W	BP	1988	Offsh 50
98/7-2	50 40 32.1 N	1 46 48.1 W	BP	1987	Offsh 46
98/11-1	50 39 13.3 N	1 49 55.2 W	British Gas	1983	Offsh 30
98/11-2	50 37 49.7 N	1 50 28.6 W	British Gas	1984	Offsh 35
98/11-3	50 39 37.0 N	1 48 43.1 W	British Gas	1986	Offsh 43
98/11-42	50 37 35.7 N	1 49 55.5 W	British Gas	1987	Offsh 44
98/16-1	50 28 22.2 N	1 54 42.4 W	Occidental	1988	Offsh 50
98/18-1	50 24 22.5 N	1 35 58.7 W	Union Oil Co	1983	Offsh 31
98/22-1B	50 14 39.1 N	1 39 22.4 W	British Gas	1979	Offsh 14
98/22-2	50 14 54.2 N	1 40 30.7 W	British Gas	1979	Offsh 16
98/23-1	50 14 35.9 N	1 31 16.0 W	Conoco	1983	Offsh 30
99/12-1	50 39 22.6 N	0 46 30.0 W	Esso	1984	Offsh 35
99/16-1	50 23 10.4 N	0 57 47.3 W	Texas Gas Exp	1983	Offsh 31
99/18-1B	50 29 13.7 N	0 33 45.4 W	Texas Gas Exp	1984	Offsh 34

Table 2: list of released, offshore petroleum wells in the Wight Sheet area.

(d) Sparker lines

A grid of shallow-seismic lines was shot by the universities who produced the first edition map. In conjunction with the sea-bed samples and boreholes these lines were used to locate geological boundaries. Only a small number of additional lines have been shot. These lines have been reinterpreted by Hamblin and Harrison (1989) and P.S. Balson (Palaeogene) (Hamblin et al., 1993).

(e) Deep-seismic surveys

The area of the Wight Sheet (Quadrants 98 and 99) is covered by a grid of seismic lines shot during the course of oil and gas exploration in the English Channel. These data are confidential and unavailable for use in this study. However, permission was obtained from Halliburton Geophysical Services Ltd (HGS) to make use of a non-exclusive, seismic survey shot by Geophysical Service International (GSI) in 1983 (Figure 1). This survey contains 2660 line-km of seismic in the map area and contains good reflectors in the upper part of the section (down to 1.5s two-way time). This survey was used to construct the depth to top Kimmeridge Clay structure map and to constrain the regional cross-sections.

The British Institutions Reflection Profiling Syndicate (BIRPS) deep line SWAT 11 crosses the sheet area in a SSE direction from Bournemouth Bay, and continues on to Cherbourg (BIRPS and ECORS,

1986; Klemperer and Hobbs, 1991). A line drawing interpretation of this section appears in Penn *et al.* (1987).

3. MAP REVISION

3.1 Amendments

The main changes to the **onshore** geological data on the second edition are:

(1) The onshore units are now labelled with chronostratigraphical designations as opposed to lithostratigraphical abbreviations.

(2) Recent remapping has resulted in many changes to the outcrop pattern, especially in the Palaeogene of the Hampshire Basin. Few alterations have been made to the Cretaceous outcrop.

The following major changes have been made to the **offshore** geology:

(1) The Chalk subcrop has been subdivided on the basis of palaeontological study into Cenomanian, Turonian and Turonian-Campanian; these approximate to the Lower, Middle and Upper Chalk onshore. South of the Central English Channel monocline the Chalk remains undivided; here the unit also includes chalk of Maastrictian age.

(2) The Palaeogene subcrop offshore has been subdivided on the basis of age into Thanetian, Ypresian, Lutetian and Bartonian (by P.S. Balson).

(3) The Chalk and Palaeogene boundaries south of Brighton have been repositioned (Hamblin and Harrison, 1989). The original data were located using Decca Mainchain and appear to have been incorrectly plotted.

(4) The separate Chalk subcrops in the "Central Channel Syncline" have been joined (Hamblin and Harrison, 1989).

(5) Offshore, the Lower Greensand, Gault and Upper Greensand have been combined into a single unit ('kakp'). In most cases the two greensands cannot be differentiated from the available samples, and the Gault Clay has not been sampled.

(6) The Portland and Purbeck beds have been combined into a single unit ('jpkz').

(7) A small, faulted outcrop of Oxford Clay ('jcjo') has been discovered within the Kimmeridge Clay of the Central English Channel High with the drilling of two deep wells (98/22-1B and 98/22-2). No sea-bed samples in this area have been assigned a similar age, and the outcrop is thought to be localised.

In addition, the following list details the mainly minor alterations that have become necessary as a result of sea-bed sampling carried out since the last map:

+50-02/298	(Kimmeridgian? clay) extends 'jd' to north
+50-02/300	(grey clay) extends Jurassic to west
+50-02/304	(Kimmeridgian mudstone) extends 'jd' to north
+50-02/306	(red-brown and grey-green mudstone) extends 'kzkb' to east
+50-02/322	(Kimmeridgian mudstone) extends 'jd' to north
+50-02/329	(chalk) extends 'kekm' to west (244 now also interpreted as chalk)
+50-02/349	(Ryazanian-Aptian, grey mudstone) extends 'kzkb' to west
+50-02/360	(Aptian-Albian, glauconitic sand) extends 'kakp' to north (see also +50-01/185)
+50-02/368	(grey mudstone) extends Jurassic to north
+50-02/402	(Ryazanian-Aptian, brown-grey sand) extends 'kzkb' to north
+50-01/185	(Albian-Cenomanian, green-grey sand) extends 'kakp' to north
+50-01/213	(chalk) extends 'kekm' to south (in addition this boundary has been moved south because BRGM Caen sheet sites +50-02/181, 183, 184, 185, 189, 190, 195 and +50-01/25, 31, 32, 33 all sampled chalk, but plot outside the chalk outcrop as drawn on the first edition map)

3.2 Additional features

(a) Geophysical logs

The gamma and sonic log curves shown on the general vertical section at a scale of 1:7500 are compiled from:

- Sandhills-1 20 to 3521 feet below Kelly Bushing (Bouldnor Formation to Lower Greensand),
- 98/18-1 1145 to 5020 feet (Wealden Beds to Inferior Oolite Group),
- 98/11-2 3441 to 11 339 feet (Lias to Aylesbeare Group)
- 98/22-2 3376 to 4440 feet (Permian breccia to Basement).

(b) **Contours on base of Palaeogene**

Onshore, top Chalk or base Palaeogene contour maps presented in Berry and Shephard-Thorn (1982), Shephard-Thorn *et al.* (1982), Wyatt *et al.* (1984), Edwards and Freshney (1987) and Bristow *et al.* (1991) are incorporated. The final contours were completed with available well information.

In the English Channel, contours on the base of the Palaeogene are based on a depth-converted seismic interpretation by R.A. Chadwick. A seismic velocity of 1800m/s was assumed for the Palaeogene. In the area of the Central English Channel Outlier, base Palaeogene contours were constructed by P.S. Balson from sparker lines.

(c) **Contours on top of Kimmeridgian**

The top Kimmeridgian contour map was constructed using the interpretation of a regional seismic grid (GSI survey Figure 1). The most obvious and consistent seismic reflector on these sections, formed by the velocity and density contrast at the top of the Purbeck anhydrite bed, was depth converted and adjusted to image the top Kimmeridgian surface. Average velocities used in the depth conversion were calculated from the sonic logs of released wells. These range from 2329m/s at a depth of 425m below sea-level to 2681m/s at 905m (velocities at depths beyond this range were extrapolated). The final contours were checked against well information.

(d) **Isopach maps with structural framework**

Three isopach maps (2 on map face, plus Figure 2) reflect the three phases in the structural evolution of the basin, and are taken directly from R.A. Chadwick in Hamblin *et al.* (1993). The structural nomenclature relevant to the particular interval is also shown. Figure 2 and Section 2 on the map do not agree - the Permo-Triassic on Section 2 wedges out near the coast in agreement with the Chichester-Begnor sheet. S. Holloway argues (pers. comm.) that the extent of the Permo-Triassic in the east (eg Middleton) has been exaggerated on the composite logs and by the Hamblin et al (1993- Figure 24)

(e) **Borehole correlation diagram**

This diagram shows a correlation of all released offshore wells (Table 2; except 98/11-1 and 98/22-1) and onshore well Southampton-1.

(f) Pre-Permian subcrop map

An extract from Smith (1985) is shown to illustrate (i) the distribution of strata subcropping the base-Permian unconformity surface, and (ii) contours on the base-Permian surface.

(g) Pre-Albian subcrop map

The pre-Albian, or pre-Lower Greensand, subcrop map shows the distribution of strata beneath this major stratigraphical break. The onshore part of this map is based on Whittaker (1985), whereas the offshore part (previously unpublished) is constructed from original well and seismic data.

(h) Regional cross-sections

These three south-to-north sections are in part speculative, but are constrained by well data, the mapped outcrop onshore and subcrop offshore, seismic data (locally), and regional isopachs. There is only limited seismic data south of the Central Channel Monocline, and no deep well data to confirm the geology shown, which is therefore only an approximation. The horizontal scale of these cross-sections is 1:250 000, the vertical exaggeration is times 10. Section 1 in the area of the Isle of Wight Monocline includes adjustments at a late draughting stage following input from A.C. Chadwick who has worked in the area.

4. GEOLOGY

The geology of the area covered by the Wight Sheet has recently been comprehensively summarized in the English Channel Offshore Regional Report (Hamblin *et al.*, 1993). This is supplemented onshore by the Hampshire Basin Regional Guide (Melville and Freshney, 1982) and the detail of the BGS sheet memoirs (in particular Edwards and Freshney, 1987; Young and Lake, 1988; Bristow *et al.*, 1991).

4.1 Structural history of the Wessex-Channel Basin

Structurally the Wight Sheet falls within the Wessex-Channel Basin as defined by Penn *et al.* (1987). This incorporates the Wessex Basin plus its offshore extension in the central and eastern English Channel. A number of sub-basins are defined on the basis of major west-east faults which were later to be reactivated to generate the classic monoclines (Wardour-Portsdown faults, Portland-Wight-Bray fault and Central English Channel fault). The major structures, all of which have undergone inversion, are: the Weald Basin (Anticline), the Hampshire-Dieppe High (Basin), the Portland-Wight Basin (High) and the Central English Channel High.

The structural history of the basin can be divided into three stages (R.A. Chadwick, in Hamblin *et al.*, 1993):

(i) *Permo-Triassic*

Subsidence began in the Early Permian but, during the Permo-Triassic, was restricted to the western part of the sheet area. Extension in Early Permian (breccias) and Early Triassic (Sherwood Sandstone Group) times was interspersed with phases of thermal subsidence in Late Permian (Aylesbeare Group) and Late Triassic (Mercia Mudstone Group) times.

(ii) *Jurassic-Early Cretaceous*

Renewed crustal extension in the Early Jurassic led to normal faulting on the Wight-Bray Fault and Weald Basin northern bounding fault. This gave way in Mid-Jurassic to Oxfordian times to regional thermal subsidence with only minor pulses of extension. Renewed crustal extension in the Kimmeridgian and Early Cretaceous led to localised faulted basins and erosion of intervening horsts and highs.

(iii) *Mid-Cretaceous to Tertiary*

The Aptian gave way to a new tectonic regime of regional thermal subsidence with greensand sediments onlapping older sediments. Subsidence continued into early and mid-Tertiary times but was ended by major Alpine inversion during the Miocene.

4.2 Stratigraphy

Lithology and thicknesses are taken from onshore outcrops (Palaeogene and Cretaceous), the Southampton-1 borehole (Jurassic), and the Wytch Farm oilfield (Permo-Triassic).

DEVONIAN

In Southampton-1, this comprises purplish grey, very fine- to fine-grained sandstone with siliceous cement interbedded with reddish-brown siltstone with abundant hematite.

DEVONIAN-CARBONIFEROUS

Grey, moderately foliated pelite with very thin, irregular, quartz veinlets (98/11-2). Generally pink, partly off-white or dark red phyllite (98/23-1). Reddish grey, hard, fissile, calcite- and chlorite-veined pelite with interbedded clear, locally pale green and red, metaquartzite (99/12-1). Small thrust slices or fault blocks of Carboniferous strata may possibly occur.

CARBONIFEROUS

Up to 300m of bituminous, crystalline, oolitic and pyritous limestones of Dinantian age Hamblin et al., 1993).

PERMIAN

Breccias (61m, max 221m 98/22-2)

Angular clasts of mica schist, well-foliated, pale grey phyllite, quartzite, dark brown claystone, pale grey-green mudstone and marble in a matrix of fine- to coarse-grained sandstones or red-brown claystones.

Aylesbeare Mudstone Group (914m, max 1463m 98/11-2)

Red-brown mudstones with minor argillaceous siltstones and sandstones are underlain by red-purple siltstones with minor fine- to medium-grained sandstones and claystones. At the base, brick-red, subfissile claystone with minor siltstone and sandstones. Elsewhere amorphous anhydrite and dolomites are also recorded. In Hamblin *et al.* (1993) this unit is termed the Aylesbeare Formation and is assigned a Triassic age.

TRIASSIC

Sherwood Sandstone Group (168m)

Variably cemented, red-brown, fine- to coarse-grained, arkosic sandstones which grade into claystones in a series of upward-fining cycles.

Mercia Mudstone Group (350-365m)

Pale to medium grey claystones with occasional thin limestones passing down into red-brown mudstones.

Penarth Group (21m)

Blocky, microcrystalline, locally argillaceous and pyritic limestones (Langport Member) underlain in the west by locally pyritic and calcareous mudstones with interbedded fine-grained, argillaceous, calcareous sandstones and argillaceous, microcrystalline limestones (Westbury Formation and Cotham Member).

JURASSIC

Lias Group

Lower Lias (12-275m)

Medium to dark grey, calcareous mudstones with pale to medium grey, argillaceous, microcrystalline limestones. Rhythmic alternations of limestone and mudstone to base (Blue Lias).

Middle Lias (1-108m)

Greenish grey, fine-grained, condensed, shelly, argillaceous limestones overlie and locally overlaps grey, silty, micaceous, calcareous mudstones.

Upper Lias (up to 170m)

Grey, calcareous, locally silty and micaceous mudstones (Upper Lias Clays) overlain by pale grey, fine- to coarse-grained, feldspathic and micaceous sandstones, alternating with well and poorly calcite-cemented interbeds; sporadically shelly (Upper Lias Sands, locally Bridport Sands Formation).

Inferior Oolite Group (up to 120m)

Grey, oolitic grainstones and argillaceous limestones on sandy, micaceous, ferruginous wackestone limestones. The group thins southwards, especially in its lower part; the top becomes argillaceous to the south and overlies hard, microcrystalline limestones.

Great Oolite Group

Fuller's Earth Formation (30-215m)

Interbedded pale grey and grey, variably calcareous mudstones; locally, grey, argillaceous limestones and shell-beds; calcarenite and oolitic grainstones in upper part to north.

Frome Clay Formation (up to 40m)

Pale grey, calcareous mudstones with shell-beds; darker, less calcareous below, with basal argillaceous limestones; lateral north and east passage to *Great Oolite Limestone* (up to 40m)

Grey, argillaceous, shelly packstones or grainstones passing north to oolitic grainstones; sandy to base.

Forest Marble Formation (25-50m)

Greyish green, calcareous mudstone; thin bioclastic limestone and fine-sandstone laminae; scattered plant and carbonaceous debris. Oolitic grainstones and micritic limestones in lower part to north.

Cornbrash Formation (5-12m)

Pale grey, fine-grained, argillaceous limestones; bioturbated shell-laminae (Lower Cornbrash) overlain by grey, medium-grained, sporadically quartzose, sandy limestones (Upper Cornbrash).

Kellaways Formation (up to 20m)

Dark grey, slightly silty, micaceous, locally carbonaceous mudstones (Kellaways Clay) overlain by grey, fine-grained, sporadically shelly, calcareous sandstones with thin, limestone doggers (Kellaways Sand).

Oxford Clay Formation (up to 150m)

Grey to brown, subfissile, calcareous, micaceous mudstones; with shell-beds. Carbonaceous and silty

at the base; thin, calcareous siltstones and argillaceous limestones towards the top.

Corallian Group (up to 70m)

Grey, rubbly, oolitic grainstones on pale-grey, fine-grained, calcareous, shell-grit sandstones, calcareous siltstones and mudstones; basal argillaceous limestone. To the south and west, the limestone thins, is argillaceous and is overlain by calcareous mudstones with very thin limestones.

Kimmeridge Clay Formation (up to 340m)

Rhythmically interbedded, medium to dark grey, shelly, fissile mudstones, pale grey, calcareous mudstones, brownish black, shelly, bituminous and phosphatic mudstones, argillaceous limestones; argillacous siltstones towards base.

Portland Group (up to 30m)

Thin, condensed, argillaceous limestones overlie brown to grey, fine- to coarse-grained, glauconitic, calcareous sandstones with limestone and phosphatic interbeds; silty and argillaceous towards base. To the south and west, thin, sandy, glauconitic limestones overlie argillaceous siltstones and silty mudstones.

CRETACEOUS-JURASSIC

Purbeck Group (up to 100m)

Thin, laminated, alternating, micritic, argillaceous limestones and in the calcareous shales with anhydrite at base. Abundantly fossiliferous with seat-earths. Locally present in the north and east, thins to 60m in south and west.

CRETACEOUS

Wealden Group

Ashdown Formation (200m)

Rhythms of sandstones and siltstones passing down into rhythms of siltstones and silty mudstones with thin sandstone beds.

Wadhurst Clay Formation (54m)

Similar lithology to Grinstead Clay (below): dark grey mudstones and pale grey, silty mudstones with a few beds of siltstone, sandstone, shelly limestone and clay-ironstone.

Lower Tunbridge Wells Sand Formation (27m)

Massive or thickly cross-bedded sandstones (Ardingly Sandstone) overlying interbedded siltstone and fine-grained, silty sandstones.

Grinstead Clay Member (25m)

Mudstones and silty mudstones with subordinate siltstones, clay-ironstones and shelly limestones. Contains one thick lenticular sandstone (Cuckfield Stone).

Upper Tunbridge Wells Sand Formation (100m)

Rhythms of sandstone, siltstone and silty mudstone.

Weald Clay Formation (175-275m)

Pale to dark grey, brown, greenish grey and red laminated silty clays and siltstones with occasional beds of sand or sandstone and thin beds of 'Paludina' limestone. Thin ironstone beds locally.

Lower Greensand Group

Atherfield Clay Formation (0-9m)

Grey to brown clay with clay-ironstone nodules. Present at outcrop only north-west of 513500 114500.

Hythe Formation (40m)

Fine-grained, silty and locally clayey sandstones which are alternately soft and weakly-cemented, and very hard and calcareous.

Sandgate Formation (17m)

Sandy and silty clays, clayey sands and glauconitic silts. East of easting 512000 [Washington], the Sandgate Beds become coarser grained and indistinguishable from the underlying Hythe Beds.

Easebourne Member (0-12m)

Glauconitic sands and calcareous sands with hard, calcareous sandstone doggers and some chert and cherty sandstones.

Folkestone Formation (0-70m)

Medium- to coarse-grained sands with irregular bands of ferruginous cement. Absent at outcrop east of easting 537500.

On the Isle of Wight the Lower Greensand Group is divided into *Atherfield Clay* (18-30m), *Ferruginous Sandstone* (70-161m), *Sandrock* (27-58m) and *Carstone formations* (6-24m).

Gault Formation (54-100m)

Grey calcareous clays and silty mudstones with bands of phosphatic nodules. Glauconitic sandy clay or ferruginous sandstone at base.

Upper Greensand Formation (0-25m)

Grey and fawn striped, bioturbated, calcareous siltstones. Absent at outcrop east of easting 532000.

Chalk Group

Lower Chalk (74-100m)

Rhythmic alternations of hard, off-white chalk and grey marl. Prominent marl unit (Plenus Marl) at top. Dark green, glauconitic, sandy marl (Glauconitic Marl) at base.

Upper and Middle Chalk (up to 325m combined)

White chalk with many flint nodule bands and some beds of nodular chalk and thin marl. Prominent hard nodular bed (Melbourn Rock) at base.

PALAEOGENE

Lambeth Group

Upnor Formation (up to 2m)

Basal bed of glauconitic clayey sand and clay with flint pebbles (Basement or Bottom Bed).

Woolwich and Reading formations (up to 30m)

East of Worthing, red-mottled clays with shells are in part estuarine or non-marine in origin.

Reading Formation (15-32m)

West of Worthing red-mottled clay or sand is marine in origin.

Thames Group

Harwich Formation (3-11m)

In the west (Bournemouth district) it comprises glauconitic, silty, fine-grained sands (Tilehurst Member), whereas in the Southampton district it is formed of bioturbated, glauconitic, clayey, silty,

fine-grained sands and sandy silts with a few thin clay bands (Basement Bed).

London Clay Formation (30-140m)

Olive-grey to greenish grey bioturbated silty and sandy clays, clayey silts, sandy clayey silts, sandy silts and silty sands. In the west (Bournemouth district) it comprises a fining-upwards cycle and then up to five coarsening-upwards cycles of clay passing upwards into fine-grained sands or interbedded sands and clays. At the western basin margin there is a reddening basal clay member (previously assigned to the Reading Formation) and two overlying sand members with only minor clay.

Bracklesham Group

In the Bournemouth district this group contains dominantly fluviatile sediments with only minor marine or estuarine deposits:

Poole Formation (30-160m)

Alternating fine- to very coarse-grained, locally pebbly, cross-bedded sands and pale grey to dark brown, carbonaceous and lignitic, commonly laminated clays. There are local red-stained, structureless clays and silty clays. Upper beds overstep the lower members to rest on the London Clay.

Branksome Sand Formation (70m)

Eight fining-upwards cycles of very coarse- to medium-grained sand capped by interbedded fine-grained sands and silty clays.

To the east, in the Southampton district, marine or estuarine deposits are dominant in the Bracklesham Group:

Wittering Formation (23-57m)

Olive-grey to brownish grey clay with partings, beds and lenses of very fine-grained sands or silts. Interfingered with wavy- to lenticular-bedded sand interbedded with clay, and fine- to medium-grained, sparsely glauconitic sand with laminae and flasers of clay.

Earnley Sand Formation (4-24m)

Green, glauconitic, bioturbated, clayey, silty, fine-grained sands and sandy silts.

Marsh Farm Formation (12-25m)

Variable amounts of sand and clay. Variably carbonaceous, laminated clays with laminae and thin beds

of fine-grained to very fine-grained sand and silt; with fine-grained to locally coarse-grained, sparsely glauconitic sands containing a variable number of clay beds and laminae.

Selsey Sand Formation (30-50m)

Glauconitic, bioturbated, commonly shelly, sandy silts to silty fine-grained sands with variable clay contents.

Barton Group

Boscombe Sand formation (20-27m)

Limited to the west of the sheet. Fine- to medium-grained, well-sorted sands with pebble and cobble beds.

Barton Clay Formation (50-90m)

Greenish grey to olive-grey, commonly glauconitic clays with a variable content of both disseminated and bedded, very fine-grained sands. Usually strongly bioturbated and shelly.

Chama Sand Formation (5-12m)

A transitional unit between the Becton Sand and Barton Clay. Greenish grey to grey, slightly glauconitic, clayey, silty, shelly, bioturbated, very fine-grained sands, silts and sandy clays.

Becton Sand Formation (7-93m)

Yellow to pale grey, well-sorted, mainly structureless, fine- to very fine-grained sands with local presence of greyish brown shelly clay (Becton Bunny Member).

Solent Group

Headon Hill Formation (75-100m Isle of Wight, 40m Southampton district)

Varied lithologies (muds, silts, sands, marls, limestones and lignites) with characteristically rapid lateral lithological changes. South-west of Southampton it comprises pale greenish grey, relatively sand-free, commonly shelly clays, silts and very fine-grained sands. Here there is a middle unit of olive-grey clay, usually extremely silty or sandy and clayey very fine-grained sand or silt with subordinate beds of pale greenish grey clay.

Bembridge Limestone Formation (1-19m)

Marly limestones and marls with subordinate muds. Thin lignites locally.

Bouldnor Formation (96m)

Basal muddy, shelly sand overlain by grey, blue-green or green muds.

5. HYDROCARBONS

The hydrocarbon prospectivity of the sheet area is summarised by Penn *et al.* (1987):

Reservoirs: Sherwood Sandstone Group, Bridport Sands and Great Oolite Group limestones. (Outside the Wight Sheet, the Corallian Group and Portland Group sandstones are also reservoirs in the Weald Basin).

Mature source rocks: Liassic clays.

Maturation and oil generation: in Mid to Late Cretaceous times.

Traps: Mesozoic horsts.

The DTI 'Brown Book' (DTI, 1992) lists the following wells that have tested significant amounts of oil or gas in the sheet area: 98/6-8, 98/7-2 and 98/11-2 offshore, and Horndean-1A, Baxter's Copse-1, Singleton-1, Lidsey-1 and Storrington-1 onshore. These discoveries are only plotted on the map if the well was released at the time of compilation.

The Wytch Farm oilfield, located mainly in the Portland Sheet area, extends into the westernmost part of this sheet beneath Poole Harbour and western Bournemouth Bay. For more details see Hinde (1980), Colter and Harvard (1981), Dranfield *et al.* (1987) and Bowman *et al.* (1993). The field limit plotted on the map is the oil-water-contact at top Sherwood Sandstone level taken from Dranfield *et al.* (1987).

6. ACKNOWLEDGEMENTS

The author of this report is also the chief author of the Wight Sheet (second edition) solid geology map. P.S. Balson, co-author of the map, provided information and interpretation on the Palaeogene outcrop also included in this report.

Halliburton Geophysical Services Ltd are thanked for giving their permission to use the GSI (1983) non-exclusive seismic survey in the construction of this map.

The following BGS staff are thanked for their comments on the map: R.A. Ellison and E.R. Shephard-Thorn (onshore, eastern part), E.C. Freshney (onshore, western part), R.W.O'B. Knox (Palaeogene), R.A. Chadwick, S. Holloway and N.J.P. Smith (deep structure) and I.E. Penn (Jurassic).

The map was edited by D. Evans and draughted by Miss J Barclay.

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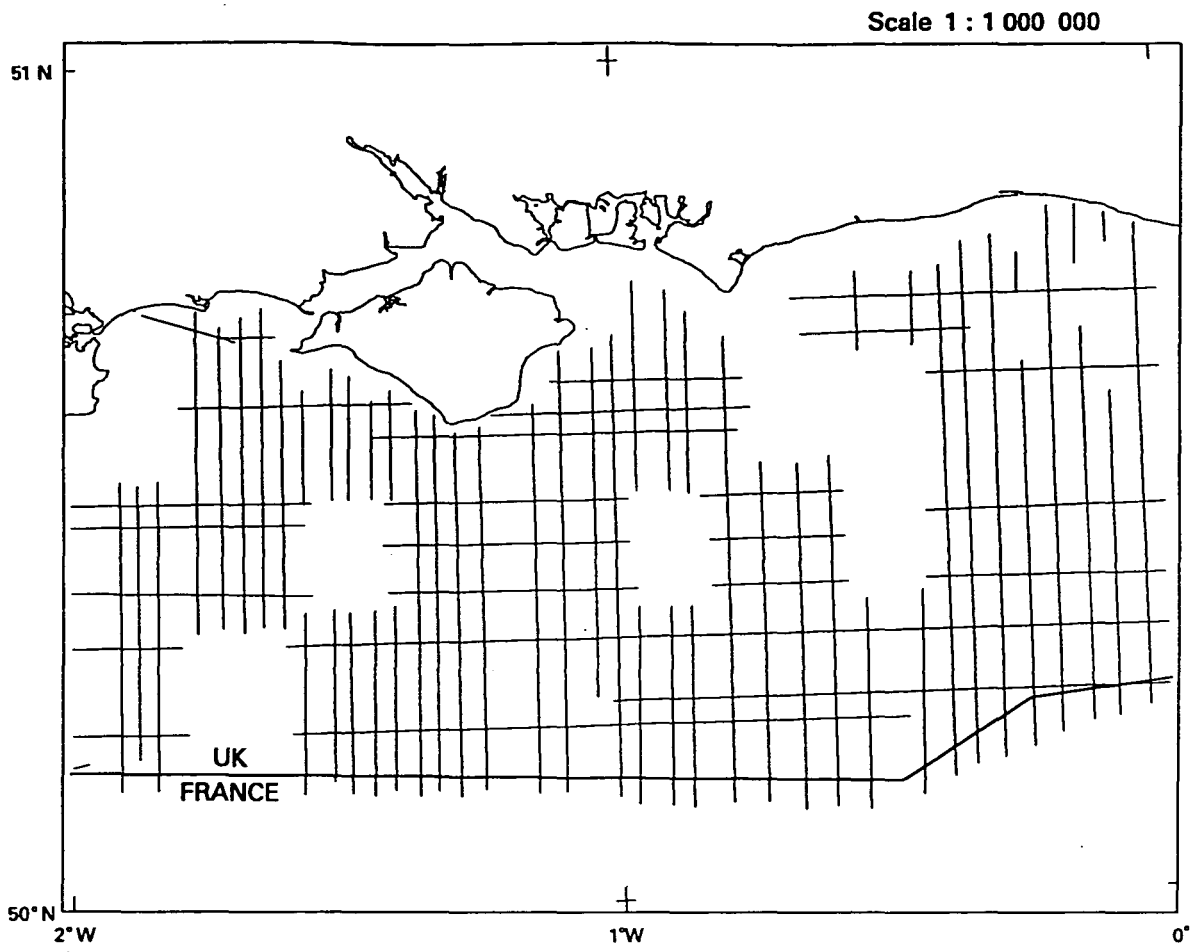

Fig. 1 Location of the GSI deep-seismic survey used during map production (by permission of Halliburton Geophysical Services Ltd)

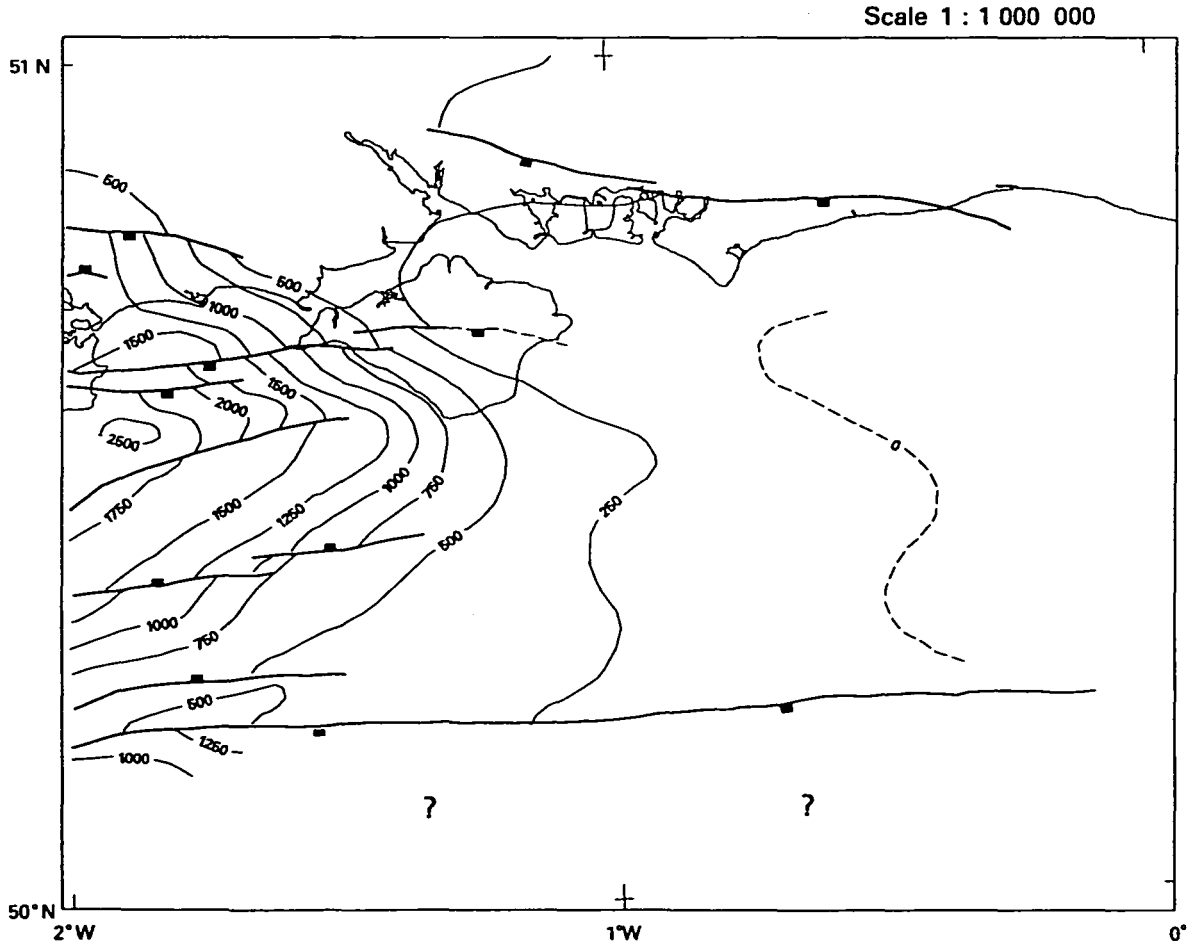

Fig. 2 Permo-Triassic isopachs in metres (from Hamblin et al., 1993)